

FORM PTO-1390 (Modified)
(REV 11-2000)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

TRANSMITTAL LETTER TO THE UNITED STATES

2872

DESIGNATED/ELECTED OFFICE (DO/EO/US)

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

CONCERNING A FILING UNDER 35 U.S.C. 371

10/019373

INTERNATIONAL APPLICATION NO.

PCT/DE00/02193

INTERNATIONAL FILING DATE

5 July 2000

PRIORITY DATE CLAIMED

17 July 1999

TITLE OF INVENTION

MONITORING DEVICE FOR OIL BURNERS

APPLICANT(S) FOR DO/EO/US

TECHT, Marco and HAUG, Rudolf

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (24) indicated below.
4. ☒ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
 - a. ☒ is attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ has been communicated by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
 - a. ☒ is attached hereto.
 - b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
 - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
 - b. ☒ have been communicated by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. ☒ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☒ A copy of the International Search Report (PCT/ISA/210).

Items 13 to 20 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☐ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
20. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
21. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
22. ☒ Certificate of Mailing by Express Mail
23. ☒ Other items or information:

EV 034735434 US

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 1.107) 107019373	INTERNATIONAL APPLICATION NO. PCT/DE00/02193	ATTORNEY'S DOCKET NUMBER 2872
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24. The following fees are submitted:				CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :					
<input type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$1040.00					
<input checked="" type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$890.00					
<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$740.00					
<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$710.00					
<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00					
ENTER APPROPRIATE BASIC FEE AMOUNT =				\$890.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).				\$0.00	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	- 20 =	0	x \$18.00	\$0.00	
Independent claims	- 3 =	0	x \$84.00	\$0.00	
Multiple Dependent Claims (check if applicable). <input type="checkbox"/>				\$0.00	
TOTAL OF ABOVE CALCULATIONS =				\$890.00	
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27). The fees indicated above are reduced by 1/2.				\$0.00	
SUBTOTAL =				\$890.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).				\$0.00	
TOTAL NATIONAL FEE =				\$890.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable). <input type="checkbox"/>				\$0.00	
TOTAL FEES ENCLOSED =				\$890.00	
				Amount to be refunded	\$
				charged	\$

- a. ☒ A check in the amount of **\$890.00** to cover the above fees is enclosed.
- b. ☐ Please charge my Deposit Account No. _____ in the amount of _____ to cover the above fees. A duplicate copy of this sheet is enclosed.
- c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **08-0114**. A duplicate copy of this sheet is enclosed.
- d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

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REGISTRATION NUMBER

DATE

Dec 29 2001

Monitoring Device for Oil Burners

The invention concerns a device for monitoring the flame of oil burners, in particular of yellow-flame or blue-flame oil burners, comprising a flame sensor detecting the illumination intensity in the burning chamber and a monitoring circuit which controls the fuel supply in dependence on the detected illumination intensity, with a luminance threshold for the starting phase of the oil burner, above which an error message is issued, and with a darkness threshold higher than the luminance threshold for the stabilization and operating phase of the oil burner, below which an error message is issued.

The European Standard EN 230 permits use of flame sensors (flame sensing elements) for the monitoring of oil burners which have an illumination intensity of at least 1 lx (Lux) in the visible range. The standard also requires a "negative switching difference" i.e. the luminance notification before fuel release (foreign light) must be given at smaller illumination intensities than a notification of darkness when the flame is extinct during operation (flame failure).

These requirements to the flame signal are shown in Fig. 2 by means of the starting process of a conventional firing automatic. Values which the flame signal must not assume are represented with hatched lines. Otherwise an error message is issued and the fuel supply is stopped.

During the starting phase I of the oil burner, the illumination intensity detected by a flame sensor in the burning chamber must not exceed the luminance threshold $B_{\max}(I)$, otherwise the fuel supply is stopped. The security phase II following the starting phase is the maximum duration from the opening of the fuel valves during which fuel can flow into the burning chamber without forming a flame. During the stabilization phase III and the operating phase IV, the detected illumination intensity must not fall below the darkness threshold $B_{\min}(III,IV)$ ($> B_{\max}(I)$) which occurs during flame failure, otherwise the fuel supply is stopped. To increase the monitoring security, the negative switching difference $\Delta B = B_{\max}(I) - B_{\min}(III,IV)$ must assume highest possible values and the luminance notification during operation must be effected at highest possible illumination intensities.

Yellow-flame oil burners (yellow burners) have a high illumination intensity in the visible region. Blue-flame oil burners (blue burners) have little radiation in the visible region,

however, start as yellow burners such that they achieve high illumination intensity at least during the starting phase. The different developments of the illumination intensities of yellow burners (a) and blue burners (B) are shown in Fig. 2.

Up to now, the different illumination intensities of the burner types were usually taken into consideration through the use of flame sensors with different sensitivity. This means for blue burners, that the flame message during operation is set to a considerably smaller illumination intensities such that foreign radiation, e.g. when the burner cap has been removed, simulates a flame and reaction to flame failure is delayed or no reaction is possible.

A further problem could be short-circuits on the conductor paths of the firing automatic, short-circuits in the feed lines to the flame controller or other short-circuits which may occur during operation with flame. Registration of flame failure is not possible during such a short-circuit.

In contrast thereto, it is the object of the invention to further develop a flame monitoring device of the above-mentioned type such that for monitoring yellow-flame or blue-flame oil burners, the same flame sensor can be used, and to further improve the security requirements of the flame monitoring devices.

This object is achieved in a first aspect of the invention in that the darkness threshold during the stabilization phase is higher than the darkness threshold during the subsequent operating phase.

For the use of the flame sensor in blue burners, the higher darkness threshold was introduced during the stabilization phase or after the security phase such that during the stabilization phase, an increased illumination intensity is required. During ignition, a blue burner starts as yellow burner and reaches the blue region only during operation, and therefore, the illumination signal during the stabilization phase is also increased. The requirement of increased illumination intensity during the stabilization phase or after the security period also reduces the danger of short-circuits with transfer resistance.

In preferred embodiments of the invention, the darkness threshold of blue-flame oil burners during operation is higher than the illumination intensity during their operating phase. During operation, a smaller illumination intensity is required to ensure safe operation of blue-flame burners.

The above-mentioned object is achieved in accordance with a second aspect of the invention also in that at least for the operating phase, the monitoring circuit has a maximum luminance threshold higher than the darkness threshold above which the fuel supply is interrupted. This maximum luminance threshold is preferably also provided for the stabilization phase and for a security phase provided between starting phase and stabilization phase.

The conventional monitoring course was supplemented by an additional maximum luminance threshold for short-circuit detection (low-ohmic short-circuits). The short-circuit detection permits exclusion of non-detected flame simulation (e.g. by a fuel-oil valve, defective flame control feed line etc.).

The inventive monitoring circuit can be realized e.g. through hardware with different switching thresholds or through analog value detection with definition of different switching thresholds via software.

The invention also concerns corresponding monitoring methods and firing automatics which are operated or equipped with such a flame monitoring device.

Further advantages of the invention can be extracted from the description and the drawing. The features mentioned above and below can be used in accordance with the invention either individually or collectively in any arbitrary combination. The embodiment shown and described is not to be understood as exhaustive enumeration but rather has exemplary character for describing the invention.

The invention is shown in the drawing and is explained in more detail with reference to an embodiment.

Fig. 1 shows a monitoring diagram of an inventive flame monitoring device with schematically indicated temporal developments of the illumination intensities of yellow-flame (a) and blue-flame (b) oil burners; and

Fig. 2 shows a monitoring diagram of conventional monitoring with schematically indicated temporal developments of the illumination intensities of yellow-flame (a) and blue-flame (b) oil burners.

To eliminate the above-described problems of the monitoring diagram in accordance with Fig. 2, the evaluation of the flame signal is changed in the monitoring diagram of Fig. 1.

The monitoring diagram of Fig. 2 was supplemented by an additional maximum luminance threshold B_{\max} for short-circuit detection (low-ohmic short-circuits) during the security, stabilization and operating phases II, III, IV and by a higher darkness threshold $B_{\min}(\text{III})$ during the stabilization phase III for an increased illumination intensity.

The possibility of flame simulation can be excluded through short-circuit detection.

During the stabilization phase III, the illumination intensity must be larger than $B_{\min}(\text{III})$. For ignition, a blue burner starts as a yellow burner and reaches the blue region only during operation, and consequently, during the stabilization phase III the illumination signal is also increased. During the operating phase IV, the darkness threshold $B_{\min}(\text{IV})$ is reduced to permit also less illumination intensity and ensure safe operation for blue burners. The requirement of an increased illumination intensity $B_{\min}(\text{III})$ after the security period II reduces the danger of short-circuits with transfer resistance.

The monitoring diagram of Fig. 1 therefore offers the following advantages:

- short-circuits during operating times with flame formation, i.e. during the stabilization phase III and the operating phase IV are reliably detected.
- Increase of the security through demand of an excessive flame signal during the stabilization phase.
- One single flame sensor type LDR (light depending resistor) can be used for yellow and blue burners thereby increasing the economy. The LDR can be used instead of the commonly used IRD (infrared flickering detector) which are much more expensive than an LDR.
- Adjustment of the flame sensors to the respective burner, which is required for IRD, is omitted.

A device for monitoring the flame of oil burners, in particular of yellow-flame or blue-flame oil burners, comprises a flame sensor detecting the illumination intensity in the burning chamber, and a monitoring circuit which controls the fuel supply in dependence on the detected illumination intensity, with a luminance threshold $B_{\max}(\text{I})$ for the starting phase I of the oil burner above which an error message is issued, and with a darkness threshold $B_{\min}(\text{III,IV})$ higher than the luminance threshold $B_{\max}(\text{I})$ for the stabilization and operating phase III,IV of the oil burner below which an error message is issued. The darkness threshold $B_{\min}(\text{III})$ is thereby higher during the stabilization phase III than the darkness threshold $B_{\min}(\text{IV})$ during the subsequent operating phase IV. Consequently, the same flame sensor can be used for yellow-flame and blue-flame oil burners.

New Claims

1. Device for the monitoring of flames of oil burners, in particular of yellow-flame or blue-flame oil burners, comprising:
 - a flame sensor detecting the illumination intensity in the burning chamber and
 - a monitoring circuit controlling the fuel supply in dependence on the detected illumination intensity, with a luminance threshold ($B_{\max}(I)$) for the starting phase (I) of the oil burner, above which an error message is issued, and with a darkness threshold ($B_{\min}(III,IV)$) higher than the luminance threshold ($B_{\max}(I)$) for the stabilization and operating phase (III,IV) of the oil burner, below which an error message is issued, characterized in that the darkness threshold ($B_{\min}(III)$) during the stabilization phase (III) is higher than the darkness threshold ($B_{\min}(IV)$) during the subsequent operating phase (IV).
2. Flame monitoring device according to claim 1, characterized in that the darkness threshold ($B_{\min}(III)$) of blue-flame oil burners during the stabilization phase (II) is higher than the illumination intensity during their operating phase (IV).
3. Flame monitoring device according to the preamble of claim 1, in particular according to claim 1 or 2, characterized in that at least for the operating phase (IV) the monitoring circuit has a maximum luminance threshold (B_{\max}) higher than the darkness threshold ($B_{\min}(IV)$) above which the fuel supply is interrupted.
4. Flame monitoring device according to claim 3, characterized in that the maximum luminance threshold (B_{\max}) is also provided for the stabilization phase (III).
5. Flame monitoring device according to claim 4, characterized in that the maximum luminance threshold (B_{\max}) is also provided for a security phase (II) provided between starting phase (I) and stabilization phase (III).
6. Firing automatic comprising a flame monitoring device according to one or more of the preceding claims.
7. Method for monitoring the flame of oil burners comprising a flame monitoring device according to claim 1, wherein the fuel supply is controlled in dependence on the illumination intensity detected in the burning chamber such that for an illumination intensity above a luminance threshold ($B_{\max}(I)$) for the starting phase (I) of the oil burner and for an illumination intensity below a darkness threshold

($B_{\min}(\text{III}, \text{IV})$) higher than the luminance threshold ($B_{\max}(\text{I})$) an error message is issued for the stabilization and operating phase (III, IV) of the oil burner, characterized in that the darkness threshold ($B_{\min}(\text{III})$) during the stabilization phase (III) is higher than the darkness threshold ($B_{\min}(\text{IV})$) during the subsequent operating phase (IV).

8. Method according to claim 7, characterized in that at least during the operating phase (IV) the fuel supply is interrupted above a maximum luminance threshold (B_{\max}) higher than the darkness threshold ($B_{\min}(\text{IV})$).

Fig. 1

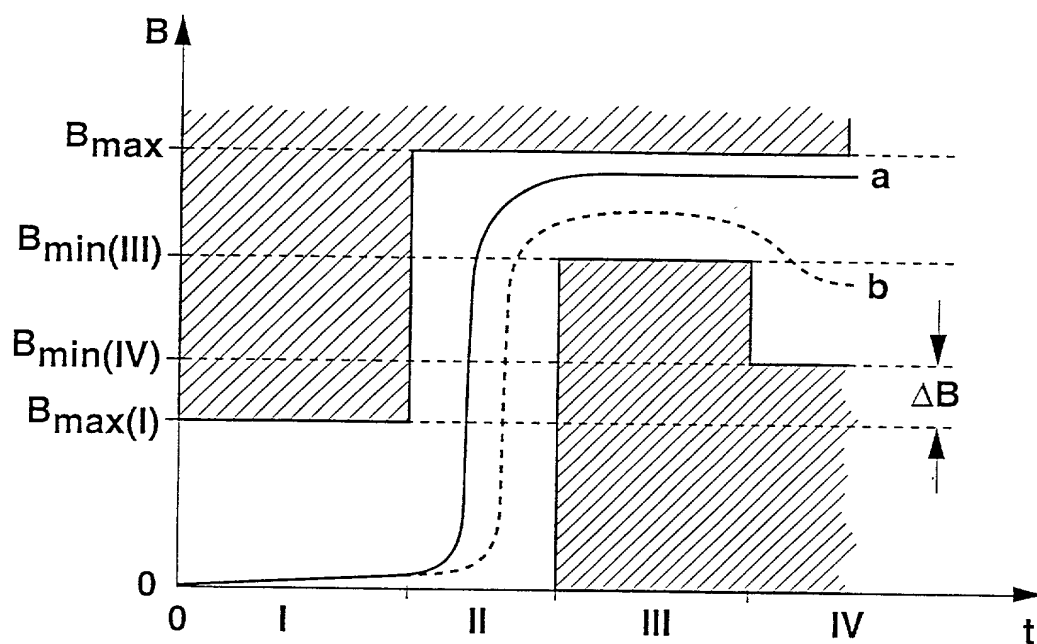
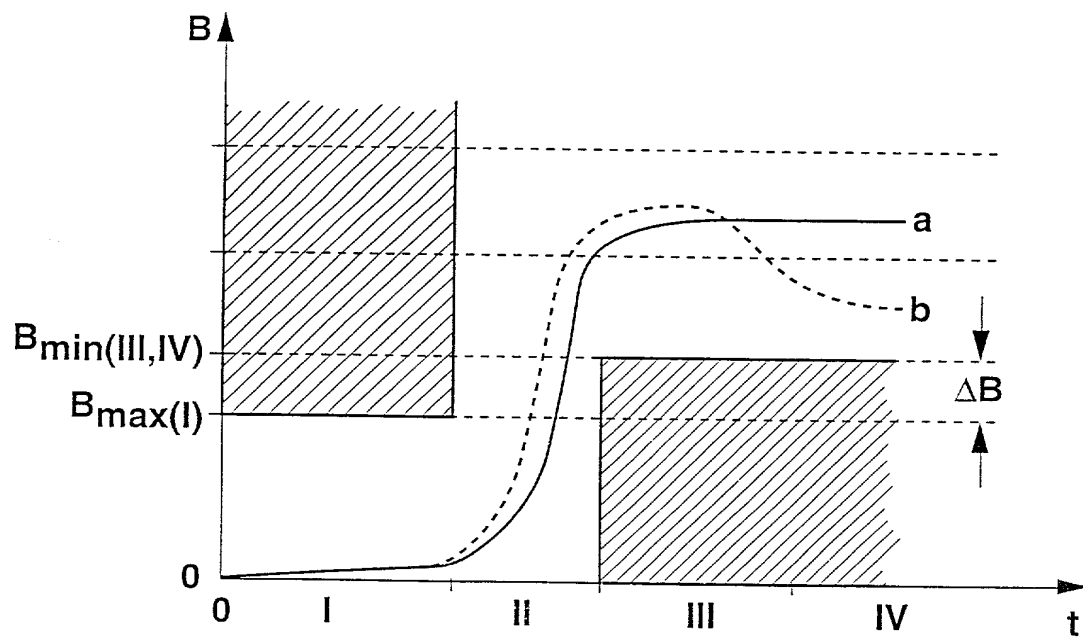


Fig. 2



Docket No.

2872

Declaration and Power of Attorney For Patent Application

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

MONITORING DEVICE FOR OIL BURNERS

the specification of which

(check one)

☒ is attached hereto.

☐ was filed on _____ as United States Application No. or PCT International Application Number _____ and was amended on _____

(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

Priority Not Claimed

DE 199 33 591.5

Germany

17 July 1999

☐

(Number)

(Country)

(Day/Month/Year Filed)

☐

(Number)

(Country)

(Day/Month/Year Filed)

☐

(Number)

(Country)

(Day/Month/Year Filed)

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

(Application Serial No.)

(Filing Date)

(Application Serial No.)

(Filing Date)

(Application Serial No.)

(Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

PCT/DE00/02193

5 July 2000

Pending

(Application Serial No.)

(Filing Date)

(Status)
(patented, pending, abandoned)

(Application Serial No.)

(Filing Date)

(Status)
(patented, pending, abandoned)

(Application Serial No.)

(Filing Date)

(Status)
(patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

Walter A. Hackler, Reg.No. 27,792

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Sole or first inventor's signature	Date
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Citizenship German	
Post Office Address same	

Full name of second inventor, if any HAUG, Rudolf	
Second inventor's signature	Date
Residence Am Streek 14, D-26655 Westerstede-Ocholt, Deutschland	
Citizenship German	
Post Office Address same	


Docket No.
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I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled
MONITORING DEVICE FOR OIL BURNERS

the specification of which

(check one)

☒ is attached hereto.

☐ was filed on _____ as United States Application No. or PCT International Application Number _____ and was amended on _____ (if applicable)

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Prior Foreign Application(s)			Priority Not Claimed
DE 199 33 591.5	Germany	17 July 1999	<input type="checkbox"/>
(Number)	(Country)	(Day/Month/Year Filed)	
_____	_____	_____	<input type="checkbox"/>
(Number)	(Country)	(Day/Month/Year Filed)	
_____	_____	_____	<input type="checkbox"/>
(Number)	(Country)	(Day/Month/Year Filed)	

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(Application Serial No.)

(Filing Date)

(Application Serial No.)

(Filing Date)

(Application Serial No.)

(Filing Date)

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PCT/DE00/02193

5 July 2000

Pending

(Application Serial No.)

(Filing Date)

(Status)
(patented, pending, abandoned)

(Application Serial No.)

(Filing Date)

(Status)
(patented, pending, abandoned)

(Application Serial No.)

(Filing Date)

(Status)
(patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

Walter A. Hackler, Reg.No. 27,792

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Second inventor's signature <i>Rudolf Haug</i>	Date 25.07.2002
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Post Office Address same	